

Study Guide

For use with pages 171–176

GOAL Write the prime factorization of a number.**VOCABULARY**

A **prime number** is a whole number that is greater than 1 and has exactly two whole number factors, 1 and itself. A **composite number** is a whole number that is greater than 1 and has more than two whole number factors.

When you write a number as a product of prime numbers, you are writing its **prime factorization**. You can use a diagram called a **factor tree** to write the prime factorization of a number.

A **monomial** is a number, a variable, or the product of a number and one or more variables raised to whole number powers.

EXAMPLE 1 Writing Factors

To play a game at a party, the guests need to divide into groups with more than 1 person and no more than 10 people. There are 30 people at the party. How many different group sizes are possible?

Solution

- (1) Write 30 as a product of two whole numbers in all possible ways.

$$1 \cdot 30 \quad 2 \cdot 15 \quad 3 \cdot 10 \quad 5 \cdot 6$$

The factors of 30 are 1, 2, 3, 5, 6, 10, 15, and 30.

- (2) Use the factors to find all the group sizes with more than 1 person but no more than 10 people.

$$\begin{array}{lll} 3 \text{ groups of } 10 & 5 \text{ groups of } 6 & \\ 10 \text{ groups of } 3 & 6 \text{ groups of } 5 & 15 \text{ groups of } 2 \end{array}$$

Answer: There are 5 possible group sizes.

Exercises for Example 1

Write all the factors of the number.

1. 42

2. 19

3. 51

4. 21

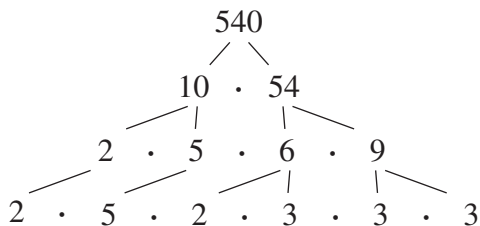
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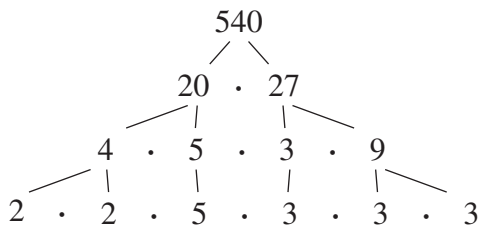
EXAMPLE 2 Writing a Prime Factorization

Write the prime factorization of 540.

One possible factor tree:



Another possible factor tree:



Both trees give the same result:

$$540 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 = 2^2 \cdot 3^3 \cdot 5.$$

Answer: The prime factorization of 540 is $2^2 \cdot 3^3 \cdot 5$.**Exercises for Example 2**Tell whether the number is *prime* or *composite*. If it is *composite*, write its prime factorization.

5. 243

6. 67

7. 78

8. 81

EXAMPLE 3 Factoring a MonomialFactor the monomial $54x^3y^2$.

$$54x^3y^2 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot x^3 \cdot y^2$$

$$= 2 \cdot 3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y$$

Write 54 as $2 \cdot 3 \cdot 3 \cdot 3$.Write x^3 as $x \cdot x \cdot x$ and y^2 as $y \cdot y$.**Exercises for Example 3**

Factor the monomial.

9. $16a^4b$

10. $25x^5y^2$

11. $64r^3t^3$

12. $19cd^6$